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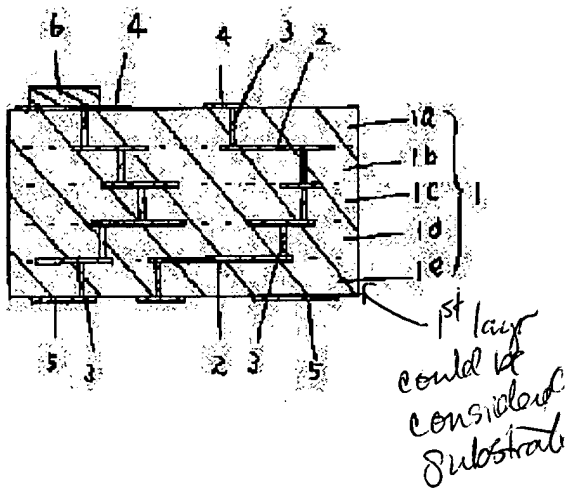
(54) LAMINATED GLASS-CERAMIC CIRCUIT BOARD

(57)Abstract:

PURPOSE: To reduce the degree of shrinkage of a laminated glass-ceramic circuit board at the time of baking the board by forming the circuit board by laminating a plurality of insulating layers containing glass components having glass- transition temperatures which are different from each other by a specific value or more.

CONSTITUTION: A laminated glass-ceramic circuit board is composed of a laminated board 1 containing circuits and surface wiring conductors 4 and 5, a thick resistor film, and a protective film are formed and electronic parts 6 connected to the conductors 4 and 5 are mounted on the main surface of the board 1 at need. The laminated board 1 is composed of insulating layers 1a-1e, internal wiring conductors 2, and via hole conductors 3 and the circuits are formed in the board 1. The glass-transition temperatures of the glass components contained in some of the insulating layers 1a-1e constituting the board 1, for example, in the insulating layers 1a and 1e are different from those of the glass components contained in the other insulating layers 1b-1d by 80°C. Therefore, the degree of shrinkage of the laminated board 1 can be reduced at the time of baking the board 1, because the shrinkage stresses generated in the insulating layers 1a-1e can be dispersed.



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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] this invention relates to low temperature, for example, the laminating ceramic circuit board which can be calcinated at about 850-1050 degrees C.
[0002]
[Description of the Prior Art] internal wiring of the laminating ceramic circuit board -- high-melting point metallic materials, such as molybdenum and a tungsten, were conventionally used as a conductor recent-years and interior wiring -- the reduction in resistance of a conductor -- following -- internal wiring -- Au, Ag, Cu(s), or those alloys are used as a conductor
[0003] this above-mentioned low resistance metallic material -- internal wiring -- when using for a conductor, the material of an insulating layer needed to be chosen according to the melting point of these metallic materials For example, the material which consists of powder of a low melting point glass-ceramics component and inorganic substance fillers, such as an alumina ceramic, is illustrated as a material of an insulating layer, the predetermined crystal phase was deposited in the grain boundary of an inorganic substance filler, and it was made to fill up with a low melting point glass-ceramics component in a baking process.
[0004] the green sheet which has inorganic substance fillers, such as a frit of a low melting point glass-ceramics component, and an alumina ceramic, as the concrete manufacture method -- forming -- this green sheet -- a beer hall -- the through hole used as a conductor -- forming -- further -- a green sheet -- a beer hall -- a conductor and internal wiring -- it consists of a low resistance metallic material used as a conductor -- each -- a conductor is formed, further, according to predetermined circuitry, the laminating unification of two or more green sheets is carried out, and, finally baking processing is performed
[0005] Baking processings are ** binder processing of about 24 - 36 hours, and an oxidizing atmosphere (air atmosphere), and consist of sintering processing with a peak temperature of 850-1050 degrees C.
[0006]
[Problem(s) to be Solved by the Invention] However, in the laminating glass ceramic circuit board, the laminated circuit board after carrying out baking processing will be contracted no less than 13 to 20% to the layered product substrate before baking processing.
[0007] Therefore, since the laminating machine used into a manufacturing process and a firing furnace had physical restrictions of a configuration, capacity, etc., it was difficult for them to obtain the laminating glass ceramic circuit board with the sufficiently big configuration after baking processing.
[0008] moreover, the substrate contraction at the time of baking -- 10% -- far -- exceeding -- since it is very large -- internal wiring -- a conductor -- the wiring piece etc. might be generated if not formed fully with careful attention to the conductor
[0009] this invention is thought out in view of an above-mentioned trouble, and the purpose offers the laminating glass ceramic circuit board with the small contraction of the substrate at the time of baking.
[0010]
[Means for Solving the Problem] The layered product substrate which carried out two or more laminatings of the insulating layer which consists of a glass component and an inorganic substance filler according to this invention in order to solve an above-mentioned technical problem, In the laminating glass ceramic circuit board which consists of

conductors and changes the internal wiring which consists of the low resistance metallic material arranged between the layers of this insulating layer -- the beer hall which consists of the low resistance metallic material arranged to the conductor and this insulating layer -- The aforementioned layered product substrate is the laminating glass ceramic circuit board of which a glass transition point carries out two or more laminatings of the insulating layer which has a glass component different 80 degrees C or more, and consists. That is, the glass transition point of the glass component of a predetermined insulating layer has the difference 80 degrees C or more as compared with the glass transition point of the glass component of other insulating layers.

[0011]

[Function] In the laminating glass ceramic circuit board, a contraction operation occurs in an insulating layer by softening flow of the glass component mainly contained in the insulating layer in the state where it does not calcinate (in fact green sheet), at the time of baking processing. Usually, this contraction is generated isotropic in all the directions.

[0012] By the way, in the insulating layer by which the laminating was carried out in the direction of a laminating, the glass transition points of a glass component differ by the predetermined insulating layer and other insulating layers like the laminating glass ceramic circuit board of this invention.

[0013] Even if contraction begins to occur in the predetermined insulating layer which follows, for example, has the glass component of a low glass transition point, other insulating layers which have the glass component of a high glass transition point are maintaining the original form. For this reason, the contraction stress generated in the insulating layer which has the glass component of a low glass transition point can act in the direction of a laminating in the insulating layer greatly, and can make an operation of the direction of a flat surface small. That is, the contraction generated in the insulating layer which has the glass component of a low glass transition point will be prevented by the insulating layer which has the glass component of a high glass transition point.

[0014] Even if contraction begins to occur in other insulating layers which have the glass component of a high glass transition point conversely, a contraction reaction is completed substantially and the predetermined insulating layer which has the glass component of a low glass transition point has become a stable state. For this reason, the contraction stress generated in the insulating layer which has the glass component of a high glass transition point can act in the direction of a laminating in the insulating layer greatly, and can make an operation of the direction of a flat surface small. That is, the contraction generated in the insulating layer which has the glass component of a high glass transition point has the glass component of a low glass transition point, and will be prevented by the insulating layer which would already be in the stable state.

[0015] preparing a temperature gradient in the flow start of glass among both insulating layers by this -- sintering -- the following contraction stress can be eased mutually superficially, it can suit, and the contraction as the whole can be made small

[0016] Consequently, restrictions are eased and a configuration, capacity, etc., such as a laminating machine and a firing furnace, can use the substrate of the configuration near the substrate of a finished product. moreover, internal wiring -- the wiring piece of a conductor etc. can be pressed down effectively and serves as the laminating glass ceramic circuit board with high flow reliability

[0017] In addition, in order to fully do an above-mentioned operation so, between the glass transition point of the glass component of the side which has a low glass transition point, and the glass transition point of the glass component of the side which has a high glass transition point, it is important to establish a temperature gradient 80 degrees C or more. If there is this temperature gradient 80 degrees C or more, in the burning temperature in which the glass component of the low transition point begins to carry out a softening flow most, the glass component of the highest transition point serves as the original form (stable state), and in the burning temperature in which the glass component of the reverse highest transition point begins to carry out a softening flow, already, most, the glass component of the low transition point will be a stable state, and will become possible [stopping a contraction effectively].

[0018]

[Example] Hereafter, the laminating glass ceramic circuit board of this invention is explained based on a drawing.

[0019] Drawing 1 is the cross section of the laminating glass ceramic circuit board concerning this invention.

[0020] from the layered product substrate 1 by which 10 is the laminating glass ceramic circuit board, and, as for the laminating ceramic circuit board 10, the predetermined circuit was formed in the interior in drawing 1 -- changing -- the need -- responding -- the principal plane of the layered product substrate 1 -- front wiring -- conductors 4 and 5, a thick-film-resistor film, and a protective coat -- forming -- further -- front wiring -- it consists of a conductor 4, various

electronic parts 6 joined on five
[0021] the layered product substrate 1 -- insulating layers 1a-1e and internal wiring -- a conductor 2 and a beer hall -- it consists of a conductor 3 and the interior of the predetermined circuit is carried out
[0022] The glass ceramic material which enables baking of insulating layers 1a-1e at the comparatively low temperature for example, around 850-1050 degrees C is used.
[0023] The inorganic substance filler contained in insulating layers 1a-1e can illustrate ceramic material, such as corundum (alpha alumina), a cristobalite, a quartz, a mullite, and a cordylite.
[0024] Moreover, a glass component consists of low melting point glass ceramics containing two or more metallic oxides, for example, deposits at least one kind in the crystal phase of a cordierite, a mullite, an anorthite, cell JIAN, a spinel, a gar night, a willemite, a dolomite, and a petalite and its substitution derivative by [around 850-1050 degrees C] carrying out baking processing at low temperature comparatively.
[0025] internal wiring -- a conductor 2 and a beer hall -- a conductor 3 -- from conductors, such as Ag system (Ag alloys, such as Ag simple substance and Ag-Pd) and Cu system (Cu simple substance, Cu alloy), -- becoming -- the thickness of an inner conductor 2 -- about 8-15 micrometers -- it is -- a beer hall -- although the diameter of a conductor can be made into arbitrary values, the diameter is 80-250 micrometers, for example
[0026] front wiring -- the conductor above-mentioned to the principal plane of the layered product substrate which conductors 4 and 5 were already formed in the layered product substrate before Ag system (Ag alloys, such as Ag simple substance and Ag-Pd), Cu system (Cu simple substance, Cu alloy), etc. consist of a conductor, for example, baking processing is carried out, and was calcinated -- printing and baking form the conductive paste containing a component
[0027] the front wiring of such a layered product substrate 1 -- a thick-film-resistor film and a protective coat are formed in conductors 4 and 5, and the various electronic parts 6, such as a letter capacitor of a chip, a letter resistor of a chip, a transistor, and IC, etc. are carried in them by solder, wirebonding, etc.
[0028] Here, as compared with the glass transition point of a containing [the glass transition point of a ****** glass component / at other insulating layers 1b-1d] glass component, the temperature gradient has 80 degrees C or more in some insulating layers, for example, 1a and 1e, among the insulating layers 1a-1e from which the characteristic thing of this invention constitutes the layered product substrate 1.
[0029] at least two kinds of glass-ceramic green sheets which will serve as insulating layers 1a, 1e, 1b-1d first if the manufacture method of the above-mentioned laminating glass ceramic circuit board is explained -- preparing -- internal wiring -- a conductor 2 and a beer hall -- a conductor 3 and front wiring -- conductors 4 and 5 and the becoming conductor -- the conductive paste which consists of the low resistance metallic material (Au, Ag, Cu(s), those alloys) for forming a film and a conductor, a glass frit, an organic vehicle,
[0030] An above-mentioned glass-ceramic green sheet carries out homogeneous kneading of a low melting point glass-ceramics frit, an inorganic substance filler, a binder, and the solvent, carries out tape molding by the doctor blade method etc., and is judged and formed in a predetermined size.
[0031] As the low melting point glass-ceramics frit was mentioned above, it consists of a glass constituent which deposits at least one kind in the crystal phase of a cordierite, a mullite, an anorthite, cell JIAN, a spinel, a gar night, a willemite, a dolomite, and a petalite and its substitution derivative by [around 850-1050 degrees C] carrying out baking processing at low temperature comparatively, and 1.0-6.0 micrometers of mean particle diameters are 1.5-3.5 micrometers preferably.
[0032] It is effective as a layered product substrate for being able to obtain a layered product substrate with more high intensity, if an anorthite and the glass frit which deposits cell JIAN are used especially, coefficient of thermal expansion being able to obtain a low layered product substrate, if the glass frit which deposits a cordierite and a mullite is used, and carrying silicon chips, such as IC bare chip, on a layered product substrate. In addition, intensity is high, and in order that coefficient of thermal expansion may obtain a low layered product substrate, B-2 O3, SiO2, aluminum 2O3, ZnO, and an alkaline-earth-metal oxide are effective as a glass constituent which deposits an anorthite and a cordierite simultaneously.
[0033] An inorganic substance filler serves as a bone agent of a layered product substrate, ceramics, such as corundum (alpha alumina), a cristobalite, a quartz, a mullite, and a cordylite, can be illustrated, and 1.0-6.0 micrometers of the particle size are 1.5-4.0 micrometers preferably.
[0034] A binder must have wettability with a formed element (a glass frit, inorganic substance filler), and its pyrolysis

nature must be good. Since it is what determines the viscosity of a slip simultaneously, the ethylene nature unsaturated compound equipped with the acrylic acid or a carboxyl group like a methacrylic-acid system polymer, and the alcohol nature hydroxyl group is desirable. As an addition, less than [25wt%] is desirable to a part for a formed element.
[0035] As a solvent, an organic system solvent and a drainage system solvent can be used. In addition, in the case of the drainage system solvent, a binder needs to be water-soluble and the functional group of a hydrophilic property, for example, a carboxyl group, is added to the binder. If the amount of addition is expressed with the acid number, there will be 2-300 and it will be 5-100 preferably.
[0036] Although an above-mentioned binder and an above-mentioned solvent must be completely pyrolyzed in the ** binder process of the heat dryness process by the doctor blade method, and the baking process of a layered product substrate, they choose 600 degrees C or less of material decomposed below 500 degrees C especially preferably.
[0037] the percentage of an above-mentioned inorganic substance filler and a glass component -- an inorganic substance filler -- 10wt(s)% - 50wt% -- desirable -- 20wt%-35wt -- it is -- a glass component -- 90wt(s)% - 50wt% -- it is 80wt%-65wt preferably
[0038] Less than [10wt%] (a glass component exceeds 90wt(s)%), a holohyaline increases [an inorganic substance filler] too much into an insulating layer, the intensity of a layered product substrate is spoiled, and the compactness of the layered product substrate 1 is spoiled in an inorganic substance filler exceeding 50wt(s)% (a glass component being less than [50wt%]).
[0039] Here, by this invention, the glass transition point of the glass frit contained in these green sheets needs to choose a glass constituent different 80 degrees C or more by the green sheet used as insulating layers 1a and 1e, and the green sheet used as insulating layers 1b-1d.
[0040] That is, it is necessary to control the glass transition point in a glass-ceramics component. For example, in an above-mentioned glass constituent, it considers as the method of setting up a glass transition point low, and is B-2 O3. It is attained by increasing the composition ratio of the oxide of ZnO or alkaline earth metal. Moreover, even if it adds oxides, such as Pb, Bi, and Cd, or adds the oxide of alkali metal, a glass transition point can be made low. However, since addition of the oxide of alkali metal may degrade the insulating property in an insulating layer, it needs to mind.
[0041] For example, using alumina ceramic powder as the glass ceramics to which the green sheet used as insulating layers 1a and 1e makes a principal component B-2 O3, SiO2, aluminum 2O3, ZnO, and an alkaline-earth-metal oxide, and an inorganic substance filler, further, the acrylic resin was used as a binder and toluene etc. was used as a solvent. In addition, the percentage of a formed element made glass ceramics and made the inorganic substance filler 30wt(s)% 70wt(s)%.
[0042] Thereby, the glass transition point obtained the green sheet containing the glass component which is 740 degrees C.
[0043] For example, using alumina ceramic powder as the glass ceramics to which the green sheet used as insulating layers 1b-1d makes a principal component PbO, B-2 O3, SiO2, aluminum 2O3, ZnO, and an alkaline-earth-metal oxide, and an inorganic substance filler, further, the acrylic resin was used as a binder and toluene etc. was used as a solvent. In addition, the percentage of a formed element made glass ceramics and made the inorganic substance filler 50wt(s)% 50wt(s)%.
[0044] Thereby, the glass transition point obtained the green sheet containing the glass component which is 600 degrees C.
[0045] [a conductive paste] -- internal wiring -- a conductor 2 and front wiring -- a conductor 4 and a beer hall -- that to which the conductive paste for forming a conductor 3 carried out homogeneous kneading of low resistance metallic-material powder, for example, silver system powder, such as Ag system (Ag alloys, such as Ag simple substance and Ag-Pd), Cu system (Cu simple substance, Cu alloy), and Au system, a low-melting-glass component, and a binder and a solvent is used moreover, front wiring -- you may use this paste also for conductors 4 and 5
[0046] a [laminating process] -- the green sheet used as insulating layers 1a-1e -- a beer hall -- the position in which a conductor 3 is formed -- taking into consideration -- NC punch etc. -- a through hole -- forming -- then, printing and restoration of above-mentioned Ag system conductivity paste -- the Sulu hall -- a conductor -- being filled up -- internal wiring of a predetermined configuration -- a conductor 2 and the becoming conductor -- the configuration of the film is carried out
[0047] The laminating of the green sheet which serves as insulating layers 1a-1e in consideration of built-up sequence in such a green sheet is carried out, it carries out thermocompression bonding, and the layered product substrate in the state

where it does not calcinate is obtained.
[0048] In addition, as shown in drawing, as for the green sheet from which a glass transition point differs, it is desirable to carry out a laminating so that it may be applicable in the thickness direction.
[0049] [Baking process] Baking processing of the layered product substrate in the above-mentioned state where it does not calcinate is carried out. Baking processing consists of ** binder process and sintering process.
[0050] the green-sheet layer which turns into insulating layers 1a-1e in ** binder process, and internal wiring -- a conductor 2 and the becoming conductor -- a film and a beer hall -- it is for the organic component contained in a conductor 3 and the becoming conductor being burned down, for example, is carried out in a temperature field 600 degrees C or less
[0051] Moreover, in sintering process, the grain boundary of an inorganic substance filler distributes uniformly at the same time the glass-ceramics component contained in the green-sheet layer used as insulating layers 1a-1e performs the deposit reaction of a predetermined crystal phase. Thereby, the firm layered product substrate 1 is attained.
[0052] moreover, internal wiring -- a conductor 2 and the becoming conductor -- a film and a beer hall -- while carrying out grain growth and making Ag system powder form into low resistance for example, it is made to unite with insulating layers 1a-1e in a conductor 3 and the becoming conductor This is performed in the temperature field which reaches the peak temperature of 850-1050 degrees C.
[0053] a firing environments is performed by air (oxidizing quality) atmosphere or neutral atmosphere -- having -- for example, internal wiring -- a conductor 2 etc. -- Cu system -- when using a conductor, it is carried out by the reducing atmosphere or neutral atmosphere
[0054] [Surface treatment process] Next, surface treatment is performed to both the principal planes of the layered product substrate by which baking processing was carried out.
[0055] for example, the beer hall formed in the upper surface side principal plane of the layered product substrate 1 at insulating layers 1a and 1e -- it connects with a conductor 3 -- as -- for example, printing and dryness of a copper system conductivity paste, and baking -- front wiring -- conductors 4 and 5 are formed here -- the front wiring of a copper system -- conductors 4 and 5 and a silver system -- the beer hall of a conductor -- a conductor 3 will join For this reason, it is important to perform the conductive paste of a copper system in a reducing atmosphere or neutral atmosphere in consideration of the eutectic temperature of silver and copper, in order to choose the thing in which low-temperature (for example, 780 degrees C or less) baking is possible and to prevent copper oxidization moreover.
[0056] Then, if needed, a thick-film resistance film, a protective coat, etc. are burned, and the various electronic parts 6 are carried.
[0057] in addition -- an above-mentioned example -- the front wiring of the layered product substrate 1 -- the case where conductors 4 and 5 are formed with the conductive paste by which baking processing is simultaneously carried out at the baking process of for example, a layered product substrate -- a laminating -- in process -- front wiring -- a conductor and the becoming conductor -- a film may be formed and you may carry out in one with baking of a layered product substrate
[0058] Moreover, if needed, the division slot is formed in the layered product substrate in the state where it does not calcinate, and immediately after baking or after performing a surface treatment process, you may perform division processing.
[0059] In the above manufacture method, especially a baking process, contraction occurs by baking processing in the layered product substrate in the state where it does not calcinate. However, in this invention, the glass transition point contains the glass component which is 600 degrees C in the layer of the green sheet from which a glass transition point serves as insulating layers 1b-1d including the glass component which is 740 degrees C at the layer of a green sheet used as insulating layers 1a and 1e.
[0060] At 500-600 degrees C while a temperature up is carried out to the peak temperature of 850-105 degrees C, the organic component contained in the layered product substrate is burned down by baking down stream processing.
[0061] Moreover, before and after about 600 degrees C, a glass component carries out a softening flow in the layer of a green sheet used as insulating layers 1b-1d, and contraction stress occurs in this layer. Although it is a layer used as insulating layers 1b-1d and generates isotropic, this contraction stress Since the laminating of the insulating layers 1a and 1e which have the glass component of the high glass transition point of 740 degrees C is carried out to the layered product substrate and insulating layers 1a and 1e are stably maintained in this temperature, The contraction stress which acts in the insulating layers [1b-1d] direction of a flat surface is eased, and it becomes contraction of the thickness

direction by insulating layers 1b-1d chiefly.
[0062] Furthermore, temperature will rise, for example, an insulating layers [1b-1d] contraction reaction will already be completed before and after 740 degrees C, and insulating layers 1b-1d will be in a stable state. Although a glass component carries out a softening flow in the layer of a green sheet used as insulating layers 1a and 1e and contraction stress occurs in such the state, since the laminating of insulating-layer 1 b-de which the contraction reaction would be completed to the layered product substrate, and would be in the stable state is carried out stably, the contraction stress which acts in the direction of a flat surface of insulating layers 1a and 1e is eased, and it becomes contraction of the thickness direction by insulating layers 1a and 1e chiefly.
[0063] Furthermore, temperature rises, for example, at 850 degrees C - 1050 degrees C, a contraction reaction will be completed also in insulating layers 1a and 1e, the grain boundary of an inorganic substance filler will be deposited and filled up with glass ceramics in a predetermined crystal phase, and it becomes a firm layered product substrate.
[0064] As mentioned above, in baking processing, since it is maintained in the state where it was stabilized in other insulating layers 1a-1e when contraction stress occurs in each insulating layers 1a-1e, it is eased mutually and the contraction stress which acts in the direction of a flat surface of the layered product substrate 1 can reduce greatly the contraction of the direction of a flat surface of the layered product substrate 1.
[0065] therefore, the internal wiring which was formed on the glee sheet since a contraction was small, i.e., the difference of the superficial size of the layered product substrate 1 became small a baking front and after baking and which was formed so that it might spread superficially -- a conductor 2 and the becoming conductor -- stress cannot start easily to a film and it becomes the laminating glass ceramic circuit board with the high reliability which an open circuit etc. cannot generate easily
[0066] Moreover, restrictions of a configuration, capacity, etc., such as a laminating machine used by the manufacturing process and a firing furnace, are eased, and the substrate of the configuration near the substrate of a finished product can be used.
[0067] [Example of an experiment] this invention person controlled glass composition so that the glass transition point of a glass component became 740 degrees C, 688 degrees C, 660 degrees C, 632 degrees C, and 600 degrees C, and he created five kinds of green sheets (it is 200 micrometers about each thickness) using each glass component.
[0068] And laminating formation was carried out by the green sheet which contains a glass component (688 degrees C, 660 degrees C, 632 degrees C, and 600 degrees C) for the green sheet of three layers in the meantime by the green sheet containing the glass component whose glass transition point is 740 degrees C about the two-layer green sheet of the maximum outside in forming the layered product substrate which carried out the laminating of the green sheet of five layers.
[0069] Then, baking processing of this layered product substrate was carried out in one at air atmosphere and the peak temperature of 900 degrees C.
[0070] The contraction in the direction of a flat surface of the layered product substrate at this time was measured.
[0071] In addition, what was formed by the green sheet which contains the glass component whose glass transition points are 740 degrees C and 600 degrees C about all the layered product substrates that consist of a green sheet of five layers as an example of comparison carried out baking processing similarly, and the contraction was measured.
[0072] The result is shown in Table 1.
[0073]
[Table 1]

試料 No	最外層のグリーンシートのガラス成分のガラス転移点	中間層のグリーンシートのガラス成分のガラス転移点	ガラス転移点の差	収縮率〔%〕
* 1	740℃	688℃	52℃	14.4
2	740℃	660℃	80℃	10.2
3	740℃	632℃	108℃	10.1
4	740℃	600℃	140℃	9.7
* 5	740℃	740℃	0	15.4
* 6	600℃	600℃	0	15.0

* 印は本発明の範囲外である。

[0074] As mentioned above, in the layered product substrate (sample numbers 5 and 6) using the green sheet of the same kind, a contraction will exceed 15%.
[0075] Moreover, although an improvement is found by the layered product substrate as compared with sample numbers 5 and 6 using the green sheet which has the glass component whose difference of two kinds of glass transition points is 52 degrees C like a sample number 1, it does not result in sufficient operation.
[0076] And like sample numbers 2-4, using the green sheet which has a glass component 80 degrees C or more, the contraction of the direction of a flat surface of a layered product substrate becomes 10% order then about a layered product substrate, and the difference of two kinds of glass transition points can do sufficient operation so.
[0077] In addition, although the upper limit of the difference of this glass transition point will be decided by low glass-transition-point temperature and peak temperature of baking, in order to carry out a softening flow and to carry out a crystallization reaction by the high glass transition point in fact, as for a setup of a high glass transition point, it is more desirable than peak temperature to fully set it as low temperature.
[0078] Moreover, the above-mentioned example constitutes the layered product substrate from the glass component of two kinds of transition points, i.e., two kinds of green sheets. And although the green sheet by the side of the high transition point is used for two-layer [of an outermost layer of drum], a layered product substrate may consist of glass components of two or more kinds of transition points, i.e., two or more kinds of green sheets. In this case, what is necessary is for the green sheet of the highest glass transition point just to enable it to maintain the original form for the temperature gradient of a low glass transition point and the highest glass transition point stably most, degrees C [80 / or more], i.e., when a low glass transition point is reached most.
[0079] Moreover, although it constitutes two-layer [of an outermost layer of drum] from a green sheet by the side of the high transition point, as long as it eases the contraction stress at the time of baking mutually and suits at the time of baking, you may arrange in any position.
[0080] moreover, the glass-ceramic slip material which replaces with a green sheet and is used for a doctor blade method although the insulating layers 1a-1e which constitute a layered product substrate are formed by the green sheet in the above-mentioned example -- printing or an application -- carrying out -- internal wiring -- a conductor and the becoming conductor -- film printing may be repeated successively and a layered product substrate may be formed

[0081] moreover, the glass-ceramic slip application film which added and applied the optical hardening monomer to this glass-ceramic slip material if needed -- receiving -- exposure and a development -- carrying out -- a beer hall -- you may make it form the through hole used as a conductor
[0082]
[Effect of the Invention] according to this invention as mentioned above -- internal wiring -- a conductor etc. is intervened and the glass transition points of the component of the glass of the glass ceramic used as a predetermined insulating layer differ by other insulating layers in the layered product substrate which the insulating layer which consists of a glass ceramic carries out two or more laminatings, and changes And the temperature gradient of this glass transition point is 80 degrees C or more.
[0083] Therefore, the contraction stress generated in an insulating layer at the time of baking processing can be distributed with burning temperature, and although the contraction stress which acts especially in the direction of a flat surface of a laminated circuit board is made to ease mutually, since it can do, the contraction of a layered product substrate can be made small.
[0084] therefore, the internal wiring formed so that it might spread superficially since the difference of the superficial size of a laminating base substrate became small a baking front and after baking -- stress cannot start easily to a conductor and it becomes the laminating glass ceramic circuit board with the high reliability which an open circuit etc. cannot generate easily
[0085] moreover, the number taken since a configuration, capacity, etc., such as a laminating machine used by the manufacturing process and a firing furnace, can enlarge the maximum area of the substrate which is restrained, and which can be manufactured -- it can increase -- etc. -- the restrictions by the manufacturing process are eased and it becomes the laminating glass ceramic circuit board of a low cost [much]

[Translation done.]

THOMSON DERWENT

MACHINE-ASSISTED TRANSLATION (MAT):

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Laminated glass-ceramic circuit substrate.

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(57)【要約】

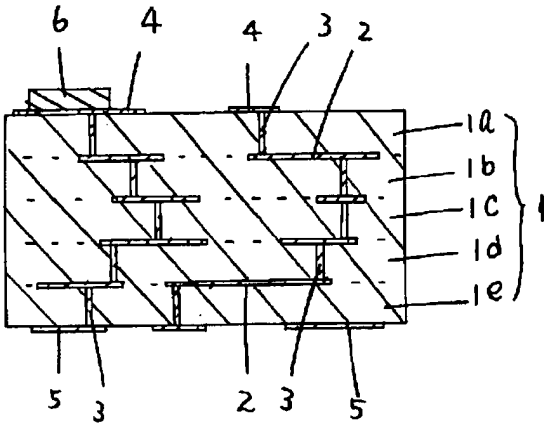
(57)[SUMMARY]

【目的】
焼成時に発生する積層体基板の平面方向の収縮率を低く抑えることができる積層ガラスーセラミック回路基板を提供する。

[OBJECT]
It is an object of the present invention to provide a laminated glass-ceramic circuit substrate capable of restraining low shrinkage factor in the direction of a flat surface of the laminate substrate occurring at the time of baking.

【構成】
ガラス成分及び無機物フィラーとから成る絶縁層１ａ～１ｅが複数積層して成る積層体基板と、該絶縁層１ａ～１ｅ間に配置した低抵抗金属材料から成る内部配線導体２と該絶縁層１ａ～１ｅに配置した低抵抗金属材料から成るビアホール導体３とから構成されて成る積層ガラスーセラミック回路基板において、前記所定絶縁層、例えば１ａ、１ｅに含まれるガラス成分のガラス転移点は、他の絶縁層、例えば１ｂ～１ｄに含まれるガラス成分のガラス転移点と比較して８０℃以上の温度差を有している。

[SUMMARY OF THE INVENTION]
In the laminated glass-ceramic circuit substrate consisting of a laminated substrate produced by laminating multiple insulating layer 1a - 1e comprising a glass component and an inorganic filler, an internal wiring conductor 2 comprising a low resister metal material arranged among these insulating layer 1a to 1e, and a via-hole conductor 3 comprising a low resister metal material arranged among the insulating layer 1a to 1e,
The glass transition point of said predetermined insulating layer, for example, the glass component contained in 1a and 1e, is 80 or more degrees C differed from that of another insulating layer, for example, glass components contained in 1b to 1d.



【特許請求の範囲】

[CLAIMS]

【請求項１】
ガラス成分及び無機物フィラーから成る絶縁層を複数積層した

[CLAIM 1]
A laminated glass-ceramic circuit substrate characterized in that consisting of a laminated

積層体基板と、該絶縁層の層間に配置した低抵抗金属材料から成る内部配線導体と該絶縁層に配置した低抵抗金属材料から成るビアホール導体とから構成されて成る積層ガラスーセラミック回路基板において、
前記積層体基板は、ガラス転移点が８０℃以上異なったガラス成分を有する絶縁層を複数積層して成ることを特徴とする積層ガラスーセラミック回路基板。

substrate laminating multiple insulating layers, an internal resister metal material comprising a low resister metal material arranged among the insulating layers, and a via-hole conductor comprising a low resistor metal material arranged among these insulating layers, wherein said laminated substrate laminating multiple insulating layers having a glass component each of which has 80 degrees C or more differed in glass transition point.

【発明の詳細な説明】

[DETAILED DESCRIPTION OF INVENTION]

【０００１】

[0001]

【産業上の利用分野】
本発明は、低温、例えば約８５０～１０５０℃で焼成可能な積層セラミック回路基板に関するものである。

[INDUSTRIAL APPLICATION]
This invention relates to the laminated ceramic circuit substrate capable of baking in a low temperature, for example, about 850 - 1050 degrees C.

【０００２】

[0002]

【従来の技術】
積層セラミック回路基板の内部配線導体として、従来、モリブデン、タングステンなどの高融点金属材料が用いられていた。
近年、内部配線導体の低抵抗化に伴い、内部配線導体として、Ａｕ、Ａｇ、Ｃｕ又はそれらの合金などが用いられるようになっている。

[PRIOR ART]
As an internal wiring conductor of a laminated ceramic circuit substrate, refractory-metal material, such as molybdenum and tungsten, was used conventionally.
In recent years, it accompanies a lowering tendency in resistance of an internal wiring conductor, and Au, Ag, Cu, or alloys thereof are used as an internal wiring conductor.

【０００３】
この上述の低抵抗金属材料を内部配線導体に用いる場合、これらの金属材料の融点に応じて絶

[0003]
When said low resistor metal material is used for an internal wiring conductor, the material of an insulating layer needed to be chosen

縁層の材料を選択する必要があった。例えば、絶縁層の材料として、低融点結晶化ガラス成分の粉末とアルミナセラミックなどの無機物フィラーとからなる材料が例示され、焼成工程においては、低融点結晶化ガラス成分を無機物フィラーの粒界に、所定結晶相を析出させて充填させていた。

according to melting point of these metal materials, for instant, the material of an insulating layer consisting of a powder of low-melting-point glass-ceramics component, and an inorganic substance fillers such as an alumina ceramic is illustrated and in a baking process, a predetermined crystal phase of low-melting-point glass-ceramics component is extracted in the grain boundary of an inorganic substance, before filling.

【０００４】
具体的な製造方法としては、低融点結晶化ガラス成分のフリット及びアルミナセラミックなどの無機物フィラーを有するグリーンシートを形成し、このグリーンシートにビアホール導体となるスルーホールを形成し、さらに、グリーンシートにビアホール導体及び内部配線導体となる低抵抗金属材料からなる各導体を形成し、さらに、所定回路構成に応じて、複数のグリーンシートを積層一体化し、最後に、焼成処理を行う。

[0004]
As a concrete manufacturing method, the green sheet which has inorganic substance fillers, such as a frit of a low-melting-point glass-ceramics component and an alumina ceramic, is formed, the through hole used as a via-hole conductor is formed to this green sheet, furthermore, each conductor comprising a low resistor metal material used as a via-hole conductor and an internal wiring conductor is formed to a green sheet, furthermore, according to a fixed-number path structure, laminated integration of some green sheets is carried out, finally, baking processing is processed.

【０００５】
焼成処理は、２４～３６時間程度の脱バインダー処理と、酸化雰囲気（大気雰囲気）で、ピーク温度８５０～１０５０℃の焼結処理とから成る。

[0005]
Baking processing process consists of a debinder process of about 24 - 36hrs, and a sintering process of peak temperature of 850-1050 degrees C in an oxidizing atmosphere (atmospheric condition).

【０００６】

[0006]

【発明が解決しようとする課題】
しかしながら、積層ガラスーセラミック回路基板では、焼成処理前の積層体基板に対して、焼

[PROBLEM ADDRESSED]
However, in a laminated glass- ceramic circuit board, the laminated circuit board after carrying out the baking processing process will be shrink no less than 13 to 20% with respect to the laminate substrate of the baking processing

成処理した後の積層基板は１３～２０％も収縮してしまう。

before processing.

【０００７】
従って、製造工程中に用いる積層機、焼成炉などには、形状・容量などの物理的な制約があるため、焼成処理後の形状が充分大きな積層ガラスーセラミック回路基板を得ることが困難であった。

[0007]
Therefore, the laminated machine and firing furnace which are used into a manufacturing process have physical restrictions of the shape, volume, etc.
Therefore, it was difficult to obtain a laminated glass-ceramic circuit substrate with the sufficiently big shape after the baking processing process.

【０００８】
また、焼成時の基板収縮率が１０％をはるかに越えて非常に大きいため、内部配線導体導体を充分に留意して形成しなくては、配線切れなどが発生することもあった。

[0008]
Moreover, substrate shrinkage percentage at the time of baking processing exceeds 10 % far, and is very large.
Therefore, the wiring breakage etc. might be generated when not formed sufficiently with careful attention to the internal wiring conductor.

【０００９】
本発明は、上述の問題点に鑑みて案出されたものであり、その目的は焼成時における基板の収縮率が小さい積層ガラスーセラミック回路基板を提供するものである。

[0009]
This invention was thought out in view of said trouble.
The objective provides a laminated glass-ceramic circuit board with small shrinkage factor of the substrate at the time of baking processing.

【００１０】

[0010]

【課題を解決するための手段】
上述の課題を解決するため、本発明によれば、ガラス成分及び無機物フィラーから成る絶縁層を複数積層した積層体基板と、該絶縁層の層間に配置した低抵抗金属材料から成る内部配線導体と該絶縁層に配置した低抵抗金属材料から成るビアホール導体とから構成されて成る積層ガラスーセラミック回路基板にお

[SOLUTION OF THE INVENTION]
In order to solve said subject, according to this invention, the laminated glass-ceramic circuit substrate formed by constructing from
The laminate substrate which laminated two or more insulating layers comprising a glass component and an inorganic substance filler, and the internal wiring conductor comprising the low resistor metal material arranged to the interlayer of this insulating layer, and the via-hole conductor comprising a low resistor metal material arranged to this insulating layer, wherein said laminate substrate is a laminated

いて、前記積層体基板は、ガラス転移点が８０℃以上異なったガラス成分を有する絶縁層を複数積層して成る積層ガラスーセラミック回路基板である。即ち、所定絶縁層のガラス成分のガラス転移点が、他の絶縁層のガラス成分のガラス転移点と比較して８０℃以上の差を有している。

glass-ceramic circuit substrate formed by laminating two or more insulating layers which have the glass component from which 80 or more degrees C of glass transition points differed.
That is, the glass transition point of the glass component of a predetermined insulating layer has the difference of 80 or more degrees C, comparing with the glass transition point of the glass component of another insulating layer.

【００１１】

[0011]

【作用】
積層ガラスーセラミック回路基板において、焼成処理時に主に未焼成状態の絶縁層（実際にはグリーンシート）に含まれるガラス成分の軟化流動によって、絶縁層に収縮作用が発生する。通常この収縮は全方向に等方的に発生する。

[EFFECT]
In a laminated glass- ceramic circuit board, a shrinkage action occurs in an insulating layer by softening flow of the glass component mainly contained in the insulating layer (in fact green sheet) of a non-bake-processed state at the time of the baking processing process.
Usually, this shrinkage is occurred omnidirectinally on an isotropic target.

【００１２】
ところで、本発明の積層ガラスーセラミック回路基板のように、積層方向に積層された絶縁層において、所定絶縁層と他の絶縁層とでガラス成分のガラス転移点が異なっている。

[0012]
By the way, the glass transition points of a glass component differ by the predetermined insulating layer and the other insulating layer in the insulating layer laminated by direction of lamination like the laminated glass-ceramic circuit substrate of this invention.

【００１３】
従って、例えば低いガラス転移点のガラス成分を有する所定絶縁層に収縮が発生し始めても、高いガラス転移点のガラス成分を有する他の絶縁層は原形を維持している。このため、低いガラス転移点のガラス成分を有する絶縁層に発生する収縮応力は、その絶縁層内の積層方向に

[0013]
Even if a shrinkage begins to occur in the predetermined insulating layer which follows, for example, has the glass component of a low glass transition point, the other insulating layer which has the glass component of a high glass transition point is maintaining the original form.
For this reason, the contraction stress occurred in the insulating layer which has the glass component of a low glass transition point acts on the direction of lamination in that insulating layer greatly, the action of the direction of a flat

大きく作用し、平面方向の作用を小さくすることができる。即ち、低いガラス転移点のガラス成分を有する絶縁層に発生する収縮は、高いガラス転移点のガラス成分を有する絶縁層によって防止されることになる。

surface can be made small.
That is, the shrinkage occurred in the insulating layer which has the glass component of a low glass transition point will be prevented by the insulating layer which has the glass component of a high glass transition point.

【００１４】
逆に、例えば高いガラス転移点のガラス成分を有する他の絶縁層に収縮が発生し始めても、低いガラス転移点のガラス成分を有する所定絶縁層は収縮反応が実質的に終了して安定状態となっている。このため、高いガラス転移点のガラス成分を有する絶縁層に発生する収縮応力は、その絶縁層内の積層方向に大きく作用し、平面方向の作用を小さくすることができる。即ち、高いガラス転移点のガラス成分を有する絶縁層に発生する収縮は、低いガラス転移点のガラス成分を有し、既に安定状態となった絶縁層によって防止されることになる。

[0014]
Even if shrinkage begin to occur in the other insulating layer which has the glass component of a high glass transition point conversely, shrinkage reaction is completed substantially and the predetermined insulating layer which has the glass component of a low glass transition point becomes a stable state.
For this reason, the contraction stress occurred in the insulating layer which has the glass component of a high glass transition point acts on the direction of lamination in that insulating layer greatly, the action of the direction of a flat surface can be made small.
That is, the shrinkage occurred in the insulating layer which has the glass component of a high glass transition point has the glass component of a low glass transition point, the insulating layer which would already be in the stable state will prevent.

【００１５】
これによって、両絶縁層間で、ガラスの流動開始に温度差を設けることにより、焼結次の収縮応力を平面的に互いに緩和しあい、全体としての収縮率を小さくすることができる。

[0015]
By this, a temperature difference is provided to the flow start of glass by both the insulation interlayer.
The contraction stress at the time of sintering is relieved mutually superficially, overall shrinkage factor can be made small.

【００１６】
その結果、積層機、焼成炉などの形状・容量などは制約が緩和され、完成品の基板に近い形状の基板を用いることができる。また、内部配線導体の配線切れ

[0016]
Consequently, as for the shape-volume, such as a laminated machine and a firing furnace, etc., restrictions are relieved, the substrate of the shape near the substrate of a finished product can be used.
Moreover, the wiring breakage of an internal

なども有効に抑えることができ、導通信頼性の高い積層ガラスーセラミック回路基板となる。

wiring conductor etc. can be restrained effectively; it becomes a laminated glass-ceramic circuit substrate with high conduction reliability.

【００１７】
尚、上述の作用を充分に奏するためには、低いガラス転移点を有する側のガラス成分のガラス転移点と、高いガラス転移点を有する側のガラス成分のガラス転移点との間には、８０℃以上の温度差を設けることが重要である。この８０℃以上の温度差があれば、最も低い転移点のガラス成分が軟化流動し始める焼成温度においては、最も高い転移点のガラス成分が原形（安定状態）となっており、逆に最も高い転移点のガラス成分が軟化流動し始める焼成温度においては、既に最も低い転移点のガラス成分が安定状態となっていることになり、収縮率を有効に抑えることが可能となる。

[0017]
In addition, in order to show said action sufficiently, between the glass transition point of the glass component of the side which has a low glass transition point, and the glass transition point of the glass component of the side which has a high glass transition point, it is important to provide the temperature difference of 80 or more degrees C.
If there is this temperature difference of 80 or more degrees C, in the calcination temperature in which the glass component of the lowest transition point begins to carry out a softening flow, the glass component of the highest transition point becomes the original form (stable state), conversely, in the calcination temperature in which the glass component of the highest transition point begins to carry out a softening flow, the glass component of the already lowest transition point will be a stable state, shrinkage factor can be restrained effectively.

【００１８】

[0018]

【実施例】
以下、本発明の積層ガラスーセラミック回路基板を図面に基づいて説明する。

[Example]
Hereafter, the laminated glass-ceramic circuit substrate of this invention is demonstrated based on the drawing.

【００１９】
図１は、本発明に係る積層ガラスーセラミック回路基板の断面図である。

[0019]
FIG. 1 is sectional drawing of the laminated glass-ceramic circuit substrate based on this invention.

【００２０】
図１において、１０は積層ガラスーセラミック回路基板であ

[0020]
In FIG. 1, 10 is a laminated glass-ceramic circuit substrate.
The laminated ceramic circuit substrate 10

り、積層セラミック回路基板１０は、内部に所定回路が形成された積層体基板１から成り、必要に応じて積層体基板１の主面に表面配線導体４、５、厚膜抵抗体膜、保護膜を形成し、さらに、表面配線導体４、５上に接合した各種電子部品６などから構成されている。

consists of the laminate substrate 1 by which the fixed-number path was formed to the inside, the front-wiring conductors 4 and 5, a thick-film-resistor film, and protective coat are formed as required to the main surface of the laminate substrate 1, furthermore, it constructs from 6 etc. of various electronic components joined on the front-wiring conductor 4 and 5.

【００２１】
積層体基板１は絶縁層１ａ～１ｅ、内部配線導体２、ビアホール導体３とから成り、所定回路が内装されている。

[0021]
The laminate substrate 1 consists of insulating-layer 1a - 1e, the internal wiring conductor 2, and the via-hole conductor 3, the fixed-number path is equipped internally.

【００２２】
絶縁層１ａ～１ｅは、例えば８５０～１０５０℃前後の比較的低い温度で焼成可能にするガラスーセラミック材料が用いられる。

[0022]
The glass-ceramic material which enables baking processing of insulating-layer 1a - 1e at the comparatively low temperature for example, before and behind 850 - 1050 degrees C is used.

【００２３】
絶縁層１ａ～１ｅに含まれる無機物フィラーは、コランダム(αアルミナ)、クリストバライト、石英、ムライト、コージライトなどのセラミック材料が例示できる。

[0023]
The inorganic substance filler contained in insulating-layer 1a-1e can illustrate ceramic material, such as corundum (alpha alumina), cristobalite, quartz, mullite, and cordierite.

【００２４】
また、ガラス成分は、複数の金属酸化物を含む低融点結晶化ガラスからなり、例えば８５０～１０５０℃前後の比較的低い温度で焼成処理することによって、コージェライト、ムライト、アノーサイト、セルジアン、スピネル、ガーナイト、ウイレマイト、ドロマイト、ペタライトやその置換誘導体の結晶相を少

[0024]
Moreover, a glass component consists of a low-melting-point glass ceramics containing some metallic oxides, for example, the baking processing process is carried out at the comparatively low temperature before and behind 850-1050 degrees C.
At least 1 type of the crystal phase of cordierite, mullet, amortize, celosia, spinal, unite, willemite, dolomite, petalite, or its substituted derivative is precipitated.

なくとも１種類を析出するものである。

【００２５】
内部配線導体２、ビアホール導体３は、Ａｇ系（Ａｇ単体、Ａｇ－ＰｄなどのＡｇ合金)、Ｃｕ系（Ｃｕ単体、Ｃｕ合金）など導体からなり、内部導体２の厚みは８～１５μｍ程度であり、ビアホール導体の直径は任意な値とすることができるが、例えばその直径は８０～２５０μｍである。

[0025]
The internal wiring conductor 2 and the via-hole conductor 3 consist of conductors, such as Ag type (Ag alloys, such as Ag simple substance and Ag-Pd) and Cu type (Cu simple substance, Cu alloy), the thickness of an inner conductor 2 is about 8 to 15 micrometer.
The diameter of a via-hole conductor can be made into arbitrary values.
However, the diameter is 80 to 250 micrometer, for example.

【００２６】
表面配線導体４、５は、Ａｇ系（Ａｇ単体、Ａｇ－ＰｄなどのＡｇ合金)、Ｃｕ系（Ｃｕ単体、Ｃｕ合金）など導体から成り、例えば、焼成処理される前の積層体基板に既に形成されたり、また、焼成された積層体基板の主面に、上述の導体成分を含む導電性ペーストを印刷、焼きつけによって形成される。

[0026]
The front-wiring conductors 4 and 5 consist of conductors, such as Ag type (Ag alloys, such as Ag simple substance and Ag-Pd) and Cu type (Cu simple substance, Cu alloy), for example, it already forms the laminate substrate before the baking processing process is carried out.
Moreover, printing and baking form the electro-conductive paste which contains said conductor component in the main surface of the bake-processed laminate substrate.

【００２７】
このような積層体基板１の表面配線導体４、５には、厚膜抵抗体膜や保護膜が形成され、チップ状コンデンサ、チップ状抵抗器、トランジスタ、ＩＣなどの各種電子部品６などが半田、ワイヤボンディングなどによって搭載されている。

[0027]
A thick-film-resistor film and protective coat are formed to such front-wiring conductors 4 and 5 of the laminate substrate 1, 6 etc. of various electronic components, such as a chip condenser, a chip resistor, a transistor, and IC, is mounted by solder, a wire bonding, etc.

【００２８】
ここで、本発明の特徴的なことは、積層体基板１を構成する絶縁層１ａ～１ｅのうち、いくつかの絶縁層、例えば１ａ、１ｅ

[0028]
Here, the characteristics of this invention is that The glass transition point of some insulating layers, for example, glass component contained in 1a and 1e among insulating-layer 1a - 1e which constructs the laminate substrate 1, has

に含れるガラス成分のガラス転移点は、他の絶縁層１ｂ～１ｄに含まれているのガラス成分のガラス転移点に比較して、その温度差が８０℃以上を有している。

a temperature difference of 80 or more degrees C, comparing with the glass transition point of the glass component contained in other insulating-layer 1b - 1d.

【００２９】
上述の積層ガラスーセラミック回路基板の製造方法について説明すると、まず、絶縁層１ａ、１ｅ、１ｂ～１ｄとなる少なくとも２種類のガラスーセラミックグリーンシートを準備し、内部配線導体２、ビアホール導体３、表面配線導体４、５となる導体膜や導体を形成するための低抵抗金属材料（Ａｕ、Ａｇ、Ｃｕ、それらの合金)、ガラスフリット、有機ビヒクルなどから成る導電性ペーストを夫々準備する。

[0029]
Description of the manufacturing method of said laminated glass-ceramic circuit substrate first provides insulating layers 1a and 1e and at least 2 type of glass-ceramic green sheet used as 1b - 1d, the low resistor metal material for forming the conductor film and conductor used as the internal wiring conductor 2, the via-hole conductor 3, and the front-wiring conductors 4 and 5 (Au, Ag, Cu, those alloys), and the electro-conductive paste comprising organic glass-frit and vehicle etc. are provided, respectively.

【００３０】
上述のガラスーセラミックグリーンシートは、低融点結晶化ガラスフリット、無機物フィラー、バインダ、溶剤を均質混練して、ドクターブレード法などでテープ成型し、所定大きさに裁断されて形成される。

[0030]
Said glass- ceramic green sheet carries out the homogeneous kneading of low-melting-point crystallization glass frit, an inorganic substance filler, a binder, and the solvent, tape casting is carried out by a doctor blade method etc., and a predetermined size cuts and it forms it.

【００３１】
低融点結晶化ガラスフリットとは、上述したように、８５０～１０５０℃前後の比較的低い温度で焼成処理することによって、コージェライト、ムライト、アノーサイト、セルジアン、スピネル、ガーナイト、ウイレマイト、ドロマイト、ペタライトやその置換誘導体の結晶相を少

[0031]
As above-mentioned, low-melting-point crystallization glass frit consists of a glass composition which precipitates at least 1 type of the crystal phase of a cordierite, mullite, anorthite, celsian, spinel, gunite, willemite, dolomite, petalite, or its substituted derivative by carrying out the baking processing process at the comparatively low temperature before and behind 850 - 1050 degrees C, a mean particle diameter is 1.0 to 6.0 micrometer, preferably 1.5

なくとも１種類を析出するガラス組成物からなり、平均粒径は、１．０～６．０μｍ、好ましくは１．５～３．５μｍである。

to 3.5 micrometer.

【００３２】
特に、アノーサイト、セルジアンを析出するガラスフリットを用いれば、より強度の高い積層体基板を得ることができ、コージェライト、ムライトを析出するガラスフリットを用いれば、熱膨張率が低い積層体基板を得ることができ、積層体基板上にＩＣベアチップなどのシリコンチップを搭載するための積層体基板として有効である。尚、強度の高く、熱膨張率が低い積層体基板を得るため、アノーサイトやコージェライトを同時に析出させるガラス組成物として、例えば、B_2O_3、SiO_2、Al_2O_3、ＺｎＯ、アルカリ土類金属酸化物が有効である。

[0032]
If the glass frit which precipitates anorthite and celsian especially is used, a strong laminate substrate can be obtained, if the glass frit which precipitates a cordierite and mullite is used, a laminate substrate with a low coefficient of thermal expansion can be obtained, it is effective as a laminate substrate for mounting silicon chips, such as IC bare chip, on a laminate substrate.
In addition, in order to obtain a laminate substrate with a high strength and a low coefficient of thermal expansion, as a glass composition which precipitates anorthite and cordierite simultaneously, B2O3, SiO2, Al2O3, ZnO, and an alkaline-earth metallic oxide are effective.

【００３３】
無機物フィラーは、積層体基板の骨剤となるものであり、コランダム（αアルミナ）、クリストバライト、石英、ムライト、コージライトなどのセラミックが例示でき、その粒径は１．０～６．０μｍ、好ましくは１．５～４．０μｍである。

[0033]
An inorganic substance filler serves as a bone agent of a laminate substrate.
Ceramics, such as corundum (alpha alumina), cristobalite, quartz, mullite, and cordierite, can be illustrated, the particle size is 1.0 to 6.0 micrometer, preferably 1.5 to 4.0 micrometer.

【００３４】
バインダは、固形成分（ガラスフリット、無機物フィラー）との濡れ性があり、熱分解性の良好なものでなくてはならない。同時にスリップの粘性を決めるものである為、アクリル酸もし

[0034]
A binder has a wettability with a solid component (glass frit, inorganic substance filler), and the thermal decomposition property must be favorable.
Since it is what determines the viscosity of a slip simultaneously, the ethylenic unsaturated compound equipped with the acrylic acid or a

くはメタクリル酸系重合体のようなカルボキシル基、アルコール性水酸基を備えたエチレン性不飽和化合物が好ましい。添加量としては固形成分分に対して２５ｗｔ％以下が好ましい。

carboxy group like a methacrylic acid type polymer, and the alcoholic hydroxyl group is preferable.
As an additional amount, 25 wt% or less per a solid component is preferable.

【００３５】
溶剤として、有機系溶剤、水系溶剤を用いることができる。尚、水系溶剤の場合、バインダは、水溶性である必要があり、バインダには、親水性の官能基、例えばカルボキシル基が付加されている。その付加量は酸価で表せば２～３００あり、好ましくは５～１００である。

[0035]
As a solvent, an organic-type solvent and a water-base solvent can be used.
In addition, in the case of a water-base solvent, a binder needs to be water-soluble.
The hydrophilic functional group, for example, a carboxy group, is added to the binder.
If the addition amount is expressed with an acid number, there is 2 - 300, preferably 5 - 100.

【００３６】
上述のバインダ及び溶剤は、ドクターブレード法による熱乾燥工程及び積層体基板の焼成工程の脱バインダ過程で完全に熱分解しなくてはならないが、特に、６００℃以下、好ましくは５００℃以下で分解する材料を選択する。

[0036]
You have to thermally decompose said binder and solvent completely in the debinder process of the heat drying process by the doctor blade method, and the baking processing process of a laminate substrate.
However, the material especially decomposed at 600 or less degrees C, preferably 500 or less degrees C, is chosen.

【００３７】
上述の無機物フィラーとガラス成分との構成比率は、無機物フィラーが１０ｗｔ％～５０ｗｔ％、好ましくは２０ｗｔ％～３５ｗｔであり、ガラス成分が９０ｗｔ％～５０ｗｔ％、好ましくは８０ｗｔ％～６５ｗｔである。

[0037]
The inorganic substance filler of the percentage of said inorganic substance filler and glass component is 10 wt% - 50 wt%, preferably 20 wt% - 35 wt%
A glass component is 90 wt% - 50 wt%, preferably 80 wt%- 65 wt%.

【００３８】
無機物フィラーが１０ｗｔ％未満（ガラス成分が９０ｗｔ％を越える）では、絶縁層中にガラ

[0038]
By 10 wt% less (a glass component exceeds 90 wt%), a glassy increases an inorganic substance filler too much into an insulating layer, the strength of a laminate substrate is

ス質が増加しすぎて、積層体基板の強度が損なわれ、無機物フィラーが５０ｗｔ％を越える（ガラス成分が５０ｗｔ％未満）では、積層体基板１の緻密性が損なわれる。

impaired, the compactness of the laminate substrate 1 is impaired in an inorganic substance filler exceeding 50 wt% (a glass component being 50 wt% less).

【００３９】
ここで、本発明では、絶縁層１ａ及び１ｅとなるグリーンシートと、絶縁層１ｂ～１ｄとなるグリーンシートとでは、これらグリーンシートに含まれるガラスフリットのガラス転移点が８０℃以上異なるガラス組成物を選択する必要がある。

[0039]
Here, at this invention, as for the green sheet used as insulating layers 1a and 1e, and the green sheet used as insulating-layer 1b-1d, it is necessary to choose the glass composition with which 80 or more degrees C of glass transition points of the glass frit contained in these green sheets differs.

【００４０】
即ち、結晶化ガラス成分におけるガラス転移点の制御を行う必要がある。例えば、上述のガラス組成物において、ガラス転移点を低く設定する方法として、B_2O_3やＺｎＯやアルカリ土類金属の酸化物の組成比を増やすことによって達成される。また、Ｐｂ、Ｂｉ、Ｃｄなどの酸化物を添加したり、アルカリ金属の酸化物を添加したりしてもガラス転移点を低くすることができる。但し、アルカリ金属の酸化物の添加は、絶縁層における絶縁特性を劣化させてしまうことがあるため留意する必要がある。

[0040]
That is, it is necessary to control the glass transition point in a glass-ceramics component. For example, it sets to said glass composition, it considers as the method of setting up a glass transition point low, and is attained by increasing the composition ratio of the oxide of B2O3, ZnO, or an alkaline earth metal. Moreover, oxides, such as Pb, Bi, and Cd, are added, even if it adds the oxide of an alkali metal, a glass transition point can be made low. However, since the addition of the oxide of an alkali metal may degrade the insulating property in an insulating layer, it needs to mind.

【００４１】
例えば、絶縁層１ａ、１ｅとなるグリーンシートは、B_2O_3、SiO_2、Al_2O_3、ＺｎＯ、アルカリ土類金属酸化物を主成分とする結晶化ガラスと無機物

[0041]
For example, an alumina ceramic powder is used for the green sheet used as insulating layers 1a and 1e as the glass ceramics which has B2O3, SiO2, Al2O3, ZnO, and an alkaline-earth metallic oxide as a main component, and an inorganic substance filler, furthermore, the

フィラーとしてアルミナセラミック粉末を用い、さらに、バインダとしてアクリル系樹脂を、溶剤としてトルエンなどを用いた。尚、固形成分の構成比率は、結晶化ガラスを７０ｗｔ％、無機物フィラーを３０ｗｔ％とした。

acrylic-type resin was used as a binder and toluene etc. was used as a solvent.
In addition, the percentage of a solid component made the glass ceramics 70 wt%.
The inorganic substance filler was made into 30 wt%.

【００４２】
これにより、ガラス転移点が７４０℃のガラス成分を含むグリーンシートを得た。

[0042]
Thereby, the glass transition point obtained the green sheet containing the glass component of 740 degrees C.

【００４３】
例えば、絶縁層１ｂ～１ｄとなるグリーンシートは、ＰｂＯ、B_2O_3、SiO_2、Al_2O_3、ＺｎＯ、アルカリ土類金属酸化物を主成分とする結晶化ガラスと無機物フィラーとしてアルミナセラミック粉末を用い、さらに、バインダとしてアクリル系樹脂を、溶剤としてトルエンなどを用いた。尚、固形成分の構成比率は、結晶化ガラスを５０ｗｔ％、無機物フィラーを５０ｗｔ％とした。

[0043]
For example, an alumina ceramic powder is used for the green sheet used as insulating-layer 1b - 1d as the glass ceramics which has PbO, B2O3, SiO2, Al2O3, ZnO, and an alkaline-earth metallic oxide as a main component, and an inorganic substance filler, furthermore, the acrylic-type resin was used as a binder and toluene etc. was used as a solvent.
In addition, the percentage of a solid component made the glass ceramics 50 wt%.
The inorganic substance filler was made into 50 wt%.

【００４４】
これにより、ガラス転移点が６００℃のガラス成分を含むグリーンシートを得た。

[0044]
Thereby, the glass transition point obtained the green sheet containing the glass component of 600 degrees C.

【００４５】

[0045]

【導電性ペースト】
内部配線導体２及び表面配線導体４、ビアホール導体３を形成するための導電性ペーストは、Ａｇ系（Ａｇ単体、Ａｇ－Ｐｄ

[Electro-conductive paste]
For the electro-conductive paste for forming the internal wiring conductor 2 and the front-wiring conductor 4, and the via-hole conductor 3, what carried out the homogeneous kneading of low resistor metal-material powder, for example, a

などのＡｇ合金)、Ｃｕ系（Ｃｕ単体、Ｃｕ合金)、Ａｕ系など低抵抗金属材料粉末、例えば銀系粉末と、低融点ガラス成分と、バインダと溶剤とを均質混練したものが用いられる。また、表面配線導体４、５にもこのペーストを用いても構わない。

silver powder, such as Ag type (Ag alloys, such as Ag simple substance and Ag-Pd), Cu type (Cu simple substance, Cu alloy), and Au type, a low-melting-glass component, and a binder and a solvent is used.
Moreover, it may use this paste also for the front-wiring conductors 4 and 5.

【００４６】

[0046]

【積層工程】
絶縁層１ａ～１ｅとなるグリーンシートに、ビアホール導体３が形成される位置を考慮してＮＣパンチ等でスルーホールを形成し、続いて、上述のＡｇ系導電性ペーストの印刷・充填により、スールホールに導体を充填し、所定形状の内部配線導体２となる導体膜を形状する。

[Laminated process]
The location to which the via-hole conductor 3 is formed is considered to the green sheet used as insulating-layer 1a-1e, and a through hole is formed to it by NC punch etc., then, by printing-filling of said Ag type electro-conductive paste, a conductor is filled to a through hole and the shape of the conductor film used as the internal wiring conductor 2 of a predetermined shape is carried out.

【００４７】
このようなグリーンシートを積層順序を考慮して、絶縁層１ａ～１ｅとなるグリーンシートを積層し、熱圧着して未焼成状態の積層体基板を得る。

[0047]
The green sheet which considers a build up sequence and is set to insulating-layer 1a-1e in such a green sheet is laminated, a thermo-compression bonding is carried out and the laminate substrate of non-bake-processed state is obtained.

【００４８】
尚、ガラス転移点の異なるグリーンシートは、図に示すように、厚み方向に対象となるように積層することが望ましい。

[0048]
In addition, as for the green sheet with different a glass transition point, it is desirable to laminate as shown in a figure, so that it may be applicable in the thickness direction.

【００４９】

[0049]

【焼成工程】
上述の未焼成状態の積層体基板を焼成処理する。焼成処理は、

[Baking processing process]
The baking processing process of the laminate substrate of said non-bake-processed state is carried out.

脱バインダ過程と焼結過程からなる。

The baking processing process consists of a debinder process and a sintering process.

【００５０】
脱バインダ過程では、絶縁層１ａ～１ｅとなるグリーンシート層、内部配線導体２となる導体膜、ビアホール導体３となる導体に含まれる有機成分を焼失するためのものであり、例えば６００℃以下の温度領域で行われる。

[0050]
It is because the organic component contained in the green-sheet layer used as insulating-layer 1a - 1e, the conductor film used as the internal wiring conductor 2, and the via-hole conductor 3 and the becoming conductor in a debinder process is burned down.
For example, it is carried out in the temperature area of 600 or less degrees C.

【００５１】
また、焼結過程では、絶縁層１ａ～１ｅとなるグリーンシート層に含まれる結晶化ガラス成分が所定結晶相の析出反応を行うと同時に、無機物フィラーの粒界に均一に分散される。これにより、強固な積層体基板１が達成される。

[0051]
Moreover, in a sintering process, it is uniformly dispersed of the grain boundary of an inorganic substance filler at the same time the glass-ceramics component contained in the green-sheet layer used as insulating-layer 1a-1e reacts a precipitate of a predetermined crystal phase.
Thereby, the firm laminate substrate 1 is attained.

【００５２】
また、内部配線導体２となる導体膜、ビアホール導体３となる導体においては、例えばＡｇ系粉末を粒成長させて、低抵抗化させるとともに、絶縁層１ａ～１ｅと一体化させるものである。これは、ピーク温度８５０～１０５０℃に達する温度領域で行われる。

[0052]
Moreover, in the conductor film used as the internal wiring conductor 2, and the via-hole conductor 3 and the becoming conductor, the grain growth of the Ag type powder is carried out, for example, while making a low resistor form, it is made to integrate with insulating-layer 1a - 1e.
This is performed in the temperature area which reaches peak temperature 850 - 1050 degrees C.

【００５３】
焼成雰囲気は、大気（酸化性）雰囲気又は中性雰囲気で行われ、例えば、内部配線導体２などにＣｕ系導体を用いる場合には、還元性雰囲気又は中性雰囲気で行われる。

[0053]
Baking processing atmosphere is performed by oxidizing atmosphere or neutral atmosphere, for example, when using Cu type conductor for 2 etc. of internal wiring conductors, it is carried out by the reducing atmosphere or neutral atmosphere.

【００５４】

【表面処理工程】
次に、焼成処理された積層体基板の両主面に表面処理を行う。

【００５５】
例えば、積層体基板１の上面側主面に、絶縁層１ａ、１ｅに形成したビアホール導体３と接続するように、例えば銅系導電性ペーストの印刷・乾燥、焼きつけにより、表面配線導体４、５を形成する。ここで、銅系の表面配線導体４、５と銀系導体のビアホール導体３とが接合することになる。このため、銀と銅との共晶温度を考慮して、銅系の導電性ペーストは低温（例えば７８０℃以下）焼成可能なものを選択し、しかも、銅の酸化を防止するために還元性雰囲気や中性雰囲気中で行うことが重要である。

【００５６】
その後、必要に応じて、厚膜抵抗膜や保護膜などを焼きつけを行い、各種電子部品６を搭載する。

【００５７】
尚、上述の実施例について、積層体基板１の表面配線導体４、５を例えば、積層体基板の焼成工程で同時に焼成処理される導電性ペーストで形成した場合、積層工程中で表面配線導体となる導体膜を形成して、積層体基板の焼成と一体的におこなっても構わない。

[0054]

[Surface-treatment process]
Next, it surface-treats to both the main surfaces of the laminate substrate by which the baking processing process was carried out.

[0055]
For example, the front-wiring conductors 4 and 5 are formed to the upper-face side main surface of the laminate substrate 1
by printing * drying and baking a copper system electro-conductive paste so that it may connect with the via-hole conductor 3 formed to insulating layers 1a and 1e, here, the front-wiring conductors 4 and 5 of a copper system and the via-hole conductor 3 of a silver conductor will join.
For this reason, the eutectic temperature of silver and copper is considered and the electro-conductive paste of a copper system chooses what can carry out low temperature (for example, 780 or less degrees C) baking processing, and in order to prevent copper oxidation, it is important to carry out in a reducing atmosphere or neutral atmosphere.

[0056]
After that, a thick-film resistor film, protective coat, etc. are burned as required, the various electronic components 6 is mounted.

[0057]
In addition, when the front-wiring conductors 4 and 5 of the laminate substrate 1 are formed about said Example with the electro-conductive paste by which the baking processing process is simultaneously carried out in the baking processing process of for example, a laminate substrate, the conductor film which serves as a front-wiring conductor in a laminated process is formed, it may carry out integrally with baking processing of a laminate substrate.

【００５８】
また、必要に応じて、未焼成状態の積層体基板に分割溝を形成しておき、焼成直後、または表面処理工程を行ったのちに分割処理を行っても構わない。

[0058]
Moreover, the divide slot is formed as required to the laminate substrate of a non-bake-processed state, it may process a divide, immediately after baking processing or after performing a surface-treatment process.

【００５９】
以上の製造方法、特に焼成工程において、未焼成状態の積層体基板には焼成処理によって収縮が発生する。しかし、本発明においては、絶縁層１ａ、１ｅとなるグリーンシートの層には、ガラス転移点が７４０℃のガラス成分を含み、絶縁層１ｂ～１ｄとなるグリーンシートの層には、ガラス転移点が６００℃のガラス成分を含んでいる。

[0059]
In the above manufacturing method, especially baking processing process, shrinkage occurs by the baking processing process in the laminate substrate of a non-bake-processed state.
However, in this invention, a glass transition point contains the glass component of 740 degrees C in the layer of the green sheet used as insulating layers 1a and 1e, the glass transition point contains the glass component of 600 degrees C in the layer of the green sheet used as insulating-layer 1b - 1d.

【００６０】
焼成処理工程で、ピーク温度８５０～１０５℃に昇温される間の５００～６００℃では、積層体基板に含まれている有機成分が焼失される。

[0060]
At 500-600 degrees C while temperature raising to peak temperature 850 - 105 degrees C, the organic component contained in the laminate substrate is burned down by the baking processing.

【００６１】
また、約６００℃前後では、絶縁層１ｂ～１ｄとなるグリーンシートの層でガラス成分が軟化流動し、この層で収縮応力が発生する。この収縮応力は、絶縁層１ｂ～１ｄとなる層で等方的に発生するものの、積層体基板には７４０℃という高いガラス転移点のガラス成分を有する絶縁層１ａ、１ｅが積層されており、この温度において絶縁層１ａ、１ｅが安定的に維持されているため、絶縁層１ｂ～１ｄの

[0061]
Moreover, before and behind about 600 degrees C, a glass component carries out a softening flow in the layer of the green sheet used as insulating-layer 1b - 1d, a contraction stress occurs in this layer.
This contraction stress is a layer used as insulating-layer 1b - 1d, and is occurred on an isotropic target.
However, the insulating layers 1a and 1e which have the glass component of the high glass transition point of 740 degrees C are laminated by the laminate substrate, since insulating layers 1a and 1e are stably maintained in this temperature, the contraction stress which acts in the insulating-layer 1b - 1d direction of a flat

平面方向に作用する収縮応力が緩和され、専ら絶縁層１ｂ～１ｄでは厚み方向の収縮となる。

surface is relieved, by insulating-layer 1b-1d, it becomes a shrinkage of the thickness direction chiefly.

【００６２】
さらに、温度が上昇して、例えば７４０℃前後では、絶縁層１ｂ～１ｄの収縮反応が既に終了して、絶縁層１ｂ～１ｄが安定状態となる。このような状態で、絶縁層１ａ、１ｅとなるグリーンシートの層でガラス成分が軟化流動し、収縮応力が発生するものの、積層体基板には収縮反応が終了し、且つ安定状態となった絶縁層１ｂ～ｄｅが安定的に積層されているので、絶縁層１ａ、１ｅの平面方向に作用する収縮応力が緩和され、専ら絶縁層１ａ、１ｅでは厚み方向の収縮となる。

[0062]
Furthermore, temperature rises, for example, before and behind 740 degrees C, insulating-layer 1b-1d shrinkage reaction is already completed, insulating-layer 1b - 1d will be in a stable state.
A glass component carries out a softening flow in the layer of the green sheet which serves as insulating layers 1a and 1e in such a state, a contraction stress occurs.
However, insulating-layer 1b - 1d which shrinkage reaction would be completed to the laminate substrate, and would be in the stable state is laminated stably.
Therefore, the contraction stress which acts in the direction of a flat surface of insulating layers 1a and 1e is relieved, by insulating layers 1a and 1e, it becomes a shrinkage of the thickness direction chiefly.

【００６３】
さらに、温度が上昇して、例えば８５０℃～１０５０℃では、絶縁層１ａ、１ｅにおいても、収縮反応が終了し、無機物フィラーの粒界に、結晶化ガラスが所定結晶相を析出して充填されることになり、強固な積層体基板となる。

[0063]
Furthermore, temperature rises, for example, at 850 degrees C - 1050 degrees C, shrinkage reaction is completed also in insulating layers 1a and 1e, to the grain boundary of an inorganic substance filler, a glass ceramics precipitates a predetermined crystal phase, and is filled.
It becomes a firm laminate substrate.

【００６４】
上述のように、焼成処理において、各絶縁層１ａ～１ｅで収縮応力が発生する時には、他の絶縁層１ａ～１ｅで安定した状態で維持されているため、積層体基板１の平面方向に作用する収縮応力が互いに緩和されて、積層体基板１の平面方向の収縮率を大きく低減することができ

[0064]
As mentioned above, in the baking processing process, when a contraction stress occurs in each insulating-layer 1a - 1e, it maintains in the state stabilized in other insulating-layer 1a-1e.
Therefore, the contraction stress which acts in the direction of a flat surface of the laminate substrate 1 is relieved mutually, shrinkage factor of the direction of a flat surface of the laminate substrate 1 can be reduced greatly.

る。

【００６５】
従って、収縮率が小さい、即ち、焼成前と焼成後とにおいて、積層体基板１の平面的な大きさの差が小さくなるため、例えばグリーシート上に形成した平面的に広がるように形成した内部配線導体２となる導体膜に対してストレスがかかりにくく、断線などが発生しにくい信頼性の高い積層ガラスーセラミック回路基板となる。

[0065]
Therefore, shrinkage factor is small, i.e., the difference of the superficial size of the laminate substrate 1 becomes small the baking processing front and after baking processing.
Therefore, a stress does not start with respect to the conductor film used as the internal wiring conductor 2 which was formed, for example on the glee sheet and which was formed so that it might spread superficially.
It becomes a laminated glass-ceramic circuit substrate with high reliability which a disconnection etc. cannot occur easily.

【００６６】
また、製造工程で用いる積層機、焼成炉などの形状・容量などの制約が緩和され、完成品の基板に近い形状の基板を用いることができる。

[0066]
Moreover, restrictions of the shape-volume, such as a laminated machine used by the manufacturing process and a firing furnace, etc. are relieved, the substrate of the shape near the substrate of a finished product can be used.

【００６７】

[0067]

【実験例】
本発明者は、ガラス成分のガラス転移点が７４０℃、６８８℃、６６０℃、６３２℃、６００℃となるようにガラス組成を制御して、各ガラス成分を用いた５種類のグリーンシート（厚みを何れも２００μｍ）を作成した。

[The example of experiment]
This inventor controls a glass composition so that the glass transition point of a glass component serves as 740 degrees C, 688 degrees C, 660 degrees C, 632 degrees C, and 600 degrees C, five kinds of green sheets (all of thickness is 200 micrometer) using each glass component were created.

【００６８】
そして、５層のグリーンシートを積層した積層体基板を形成するにあたり、最外側の２層のグリーンシートをガラス転移点が７４０℃のガラス成分を含むグリーンシートで、その間の３層のグリーンシートを６８８℃、、

[0068]
And in order to form the laminate substrate which laminated the green sheet of five layers, the glass transition point formed lamination the green sheet of two layers of an outermost side by the green sheet containing the glass component of 740 degrees C.
The green sheet of three layers in the meantime was formed lamination by the green sheet containing the glass component of 688 degrees

６６０℃、６３２℃、６００℃のガラス成分を含むグリーンシートで積層形成した。

C, 660 degrees C, 632 degrees C, and 600 degrees C.

【００６９】
その後、この積層体基板を、大気雰囲気、ピーク温度９００℃で一体的に焼成処理した。

[0069]
After that, the baking processing process of this laminate substrate was integrally carried out at atmospheric-condition and peak temperature 900 degrees C.

【００７０】
この時の積層体基板の平面方向での収縮率を測定した。

[0070]
Shrinkage factor in the direction of a flat surface of the laminate substrate at this time was measured.

【００７１】
尚、比較例として、５層のグリーンシートからなる積層体基板を、全てガラス転移点が７４０℃、６００℃のガラス成分を含むグリーンシートで形成したものも同様して焼成処理して、収縮率を測定した。

[0071]
In addition, all the laminate substrates comprising the green sheet of five layers were formed as a Comparative example by the green sheet containing the glass component having a glass transition point of 740 degrees C and 600 degrees C.
This carries out the baking processing process similarly.
Shrinkage factor was measured.

【００７２】
その結果を表１に示す。

[0072]
The result is shown to Table 1.

【００７３】

[0073]

【表１】

[Table 1]

試料No	最外層のグリーンシートのガラス成分のガラス転移点	中間層のグリーンシートのガラス成分のガラス転移点	ガラス転移点の差	収縮率〔%〕
* 1	740℃	688℃	52℃	14.4
2	740℃	660℃	80℃	10.2
3	740℃	632℃	108℃	10.1
4	740℃	600℃	140℃	9.7
* 5	740℃	740℃	0	15.4
* 6	600℃	600℃	0	15.0

* 印は本発明の範囲外である。

First Row (Left to Right):

Sample No.,

Glass transition point of glass component in outermost green sheet.

Glass transition point of glass component in intermediate green sheet.

Difference in glass transition point.

Shrinkage factor (%).

Mark * is out of the range of this invention.

【００７４】
以上のように、同一の種類のグリーンシートを用いた積層体基板（試料番号５、６）では、収縮率が１５％を越えてしまう。

[0074]
As mentioned above, in the laminate substrate (sample numbers 5 and 6) using the green sheet of the same kind, shrinkage factor will exceed 15 %.

【００７５】
また、試料番号１のように、２種類のガラス転移点の差が５２℃のガラス成分を有するグリーンシートを用いて積層体基板では、試料番号５、６に比較し

[0075]
Moreover, by the laminate substrate, improvement is found like a sample number 1 compared with sample numbers 5 and 6 using the green sheet in which the difference of two kinds of glass transition points has the glass component of 52 degrees C.

て、改善は見られるものの、充分な作用には到らない。

However, it does not result in sufficient action.

【００７６】
そして、試料番号２～４のように、２種類のガラス転移点の差が８０℃以上のガラス成分を有するグリーンシートを用いて積層体基板をでは、積層体基板の平面方向の収縮率は１０％前後となり、充分な作用を奏することができる。

[0076]
And as the sample number 2-4, with the laminate substrate using the green sheet in which the difference of two kinds of glass transition points has the glass component of 80 or more degrees C, shrinkage factor in the direction of flat surface of a laminate substrate becomes about 10% order, sufficient action can be shown.

【００７７】
尚、このガラス転移点の差の上限は、低いガラス転移点温度と焼成のピーク温度とで決まることになるが、実際には、高いガラス転移点で軟化流動して、結晶化反応するためには、高いガラス転移点の設定は、ピーク温度よりも充分に低い温度に設定することが望ましい。

[0077]
In addition, the upper limit of the difference of this glass transition point will be decided by low glass-transition-point temperature and peak temperature of baking processing.
However, in fact, in order to carry out a softening flow and to carry out crystallization reaction by the high glass transition point, as for a setup of a high glass transition point, it is desirable to set it as temperature sufficiently lower than peak temperature.

【００７８】
また、上述の実施例では、２種類の転移点のガラス成分、即ち、２種類のグリーンシートで積層体基板を構成している。しかも、高い転移点側のグリーンシートを最外層の２層に用いているが、２種類以上の転移点のガラス成分、即ち、２種類以上のグリーンシートで積層体基板を構成してもよい。この場合、最も低いガラス転移点と最も高いガラス転移点の温度差を８０℃以上、即ち、最も低いガラス転移点に達した時点では、最も高いガラス転移点のグリーンシートが安定的に原形を維持できるようにすればよい。

[0078]
Moreover, in said Example, the laminate substrate is constructed of the glass component of two kinds of transition points, i.e., two kinds of green sheets.
And the green sheet by the side of a high transition point is used for two layers of outermost layer.
However, it may construct a laminate substrate of the glass component of 2 or more types of transition point, i.e., 2 or more types of green sheet.
In this case, the temperature difference of the lowest glass transition point and the highest glass transition point is maintained to 80 or more degrees C.
Namely, what is necessary is for the green sheet of the highest glass transition point just to enable it to maintain the original form stably, when the lowest glass transition point is

reached.

【００７９】
また、最外層の２層を高い転移点側のグリーンシートで構成しているが、焼成時に、焼成時の収縮応力を互いに緩和しあえば、どの位置に配置しても構わない。

[0079]
Moreover, it is constructing by the green sheet by the side of a transition point with outermost layer high two layers.
However, if the contraction stress at the time of baking processing is mutually relieved at the time of baking processing, it may arrange to any location.

【００８０】
また、上述の実施例では、積層体基板を構成する絶縁層１ａ～１ｅがグリーンシートで形成されているが、グリーンシートに代えて、ドクターブレード法に用いるガラスーセラミックスリップ材を印刷又は塗布を行い、内部配線導体となる導体膜印刷を順次繰り返して積層体基板を形成しても構わない。

[0080]
Moreover, in said Example, insulating-layer 1a - 1e which constructs a laminate substrate is formed by the green sheet.
However, it replaces with a green sheet and printing or an application is performed for the glass- ceramic slip material used for a doctor blade method, the conductor-film printing used as an internal wiring conductor may be repeated in order, and a laminate substrate may be formed.

【００８１】
また、このガラスーセラミックスリップ材に、必要に応じて、光硬化モノマーを添加して、塗布したガラスーセラミックスリップ塗布膜に対して、露光・現像処理して、ビアホール導体となるスルーホールを形成するようにしても構わない。

[0081]
Moreover, a photosetting monomer is added to this glass-ceramic slip material as required, it carries out an exposure-development with respect to the applied glass-ceramic slip coating film, it may make it form the through hole used as a via-hole conductor.

【００８２】

[0082]

【発明の効果】
以上のように本発明によれば、内部配線導体などを介在して、ガラスーセラミックから成る絶縁層が複数積層して成る積層体基板において、所定絶縁層となるガラスーセラミックのガラス

[EFFECT OF THE INVENTION]
According to this invention as mentioned above, in the laminate substrate which interposes an internal wiring conductor etc., and two or more insulating layers comprising a glass- ceramic laminate, and changes, the glass transition points of the component of the glass of a glass-ceramic used as a predetermined insulating

の成分のガラス転移点が他の絶縁層で異なる。そして、このガラス転移点の温度差が８０℃以上となっている。

layer differ by the other insulating layer.
And the temperature difference of this glass transition point has 80 or more degrees C.

【００８３】
従って、焼成処理時に絶縁層に発生する収縮応力を、焼成温度によって分散させることができ、特に積層基板の平面方向に作用する収縮応力を互いに緩和させるができるため、積層体基板の収縮率を小さくすることができる。

[0083]
Therefore, the contraction stress occurred in an insulating layer can be made dispersed with a calcinations temperature at the time of the baking processing process.
It can do, although the contraction stress which acts especially in the direction of a flat surface of a laminated circuit board is relieved mutually.
Therefore, shrinkage factor of a laminate substrate can be made small.

【００８４】
従って、焼成前と焼成後とにおいて、積層基体基板の平面的な大きさの差が小さくなるため、平面的に広がるように形成した内部配線導体に対してストレスがかかりにくく、断線などが発生しにくい信頼性の高い積層ガラスーセラミック回路基板となる。

[0084]
Therefore, the difference of the superficial size of a laminated base-material substrate becomes small the baking processing front and after baking processing.
Therefore, a stress does not start with respect to the internal wiring conductor formed so that it might spread superficially.
It becomes a laminated glass-ceramic circuit substrate with high reliability which a disconnection etc. cannot occur easily.

【００８５】
また、製造工程で用いる積層機、焼成炉などの形状・容量などは制約される製造できる基板の最大面積を、大きくすることができるため、多数個取りの個数を増やすことができなど、製造工程での制約が緩和され、低コストの積層ガラスーセラミック回路基板となる。

[0085]
Moreover, the shape-volume, such as a laminated machine used by the manufacturing process and a firing furnace, etc. can enlarge the maximum area of the substrate which is restrained and which can be manufactured.
Therefore, the number of multiple part yielding can be increased.
The restrictions by the manufacturing process are relieved, it becomes an inexpensive laminated glass- ceramic circuit substrate.

【図面の簡単な説明】

[BRIEF EXPLANATION OF DRAWINGS]

【図１】
本発明に係る積層ガラスーセラ

[FIGURE 1]
It is sectional drawing of the laminated glass-ceramic substrate based on this invention.

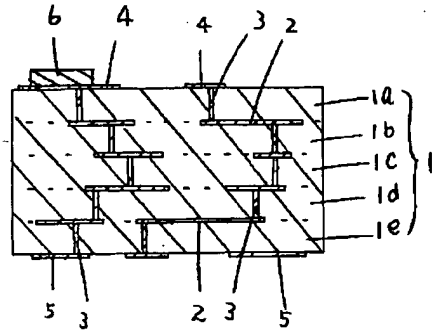
ミック基板の断面図である。

【符号の説明】
１０・・・・・・積層ガラスーセラミック回路基板
１・・・・・・・積層体基板
１ａ～１ｅ・・・絶縁層
２・・・・・・・内部配線導体
３・・・・・・・ビアホール導体
４、５・・・・・表面配線導体
６・・・・・・・電子部品

[EXPLANATION OF DRAWING]
10******* laminated glass- ceramic circuit board
1******* *laminate substrate
1a-1e*** insulating layer
2*******::Inside wiring conductor
3******** via-hole conductor
4, 5****** front-wiring conductor
6******** electronic component

【図１】

[FIGURE 1]



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